



TNRCC TECHNICAL GUIDANCE

PETROLEUM STORAGE TANK DIVISION

SUBJECT: **Soil and Groundwater Sampling and Analysis**

In order to determine the effects of a leak or spill from a product storage tank upon the environment, the Texas Natural Resource Conservation Commission (TNRCC) may require that a contamination assessment study be conducted at the site. During the contamination assessment study, samples of soil and often groundwater are collected at the site and analyzed for levels of contamination by a professional laboratory. **Samples must be collected, preserved, handled, and analyzed in an EPA-approved manner in order to be accepted by the TNRCC.** EPA-prescribed collection, preservation, handling and analytical methods are listed in EPA publication SW846. It is the responsibility of the individual collecting the samples to know the proper EPA methods that are to be used. To aid the responsible party, brief answers are provided for questions commonly asked of the TNRCC regarding the collection and analysis of soil and groundwater samples at leaking product storage tank sites.

SOIL SAMPLE COLLECTION

Why is it necessary that soil samples be collected and analyzed by a laboratory?

The laboratory analysis of soil samples is necessary to determine:

- ⟨ if soil at the site has been contaminated by the leak or spill and if so, how badly;
- ⟨ how far the released product has spread in the soil; and
- ⟨ the depth to which the released product has spread in the soil.

How are soil samples collected?

- ⟨ When collecting soil samples from excavations such as open tank pits, samples can be collected with decontaminated tools such as shovels, push tubes, or similar devices. Soil samples should be collected from representative soils which have not been exposed to the atmosphere for any length of time. Always thoroughly clean the tool between each sampling.
- ⟨ In order to collect samples from below the ground surface where open excavations are not present, soil borings are generally installed with drilling equipment.
- ⟨ Soil samples should be collected from a decontaminated split-spoon sampler, Shelby tube, or similar sampling device when drilling soil borings.

While installing the borings, how often should soil samples be collected?

- ⟨ Soil samples should be collected continuously to the bottom of each boring. Less frequent sampling may be allowed when deep borings (greater than 50 feet) are installed.

Which soil samples should be submitted to the laboratory for analysis?

- ⟨ In order to determine which soil samples should be submitted for laboratory analysis, the TNRCC recommends that soil samples be field screened using an instrument designed to check for the presence of vapors from contaminants released



from the storage tank. However, the sample should be split prior to field screening so that the sample actually sent to the laboratory has not been subjected to the screening. The need for analysis of particular samples may also become obvious upon visual inspection of the samples.

For soil samples collected from borings, the number of samples to be submitted for laboratory analysis is dependent on whether a groundwater producing zone is encountered while drilling. If a groundwater producing zone is not encountered, two samples from each boring are required:

- ⟨ one from the zone of highest contamination based upon field screening results, and
- ⟨ one from the bottom of the boring.

If a groundwater producing zone is encountered, three samples from each boring are required:

- ⟨ one from the zone of highest contamination based upon field screening results;
- ⟨ one from immediately above the saturated zone; and
- ⟨ one from the bottom of the boring.

If it is necessary to submit more samples to the laboratory, please contact the TNRCC case coordinator prior to submitting the samples to the laboratory.

How should soil samples be handled?

- ⟨ Each sample should be collected using clean disposable gloves and other clean sampling utensils.
- ⟨ Soil samples should be immediately collected from the sampling device once the device is retrieved from the borehole or tankhold, etc. to limit exposure of the samples to effects of wind and heat.
- ⟨ Samples which are to be sent to the laboratory for analysis should be immediately placed in sterilized sample jars provided by the laboratory. The specific container size and type required is dependent upon the type of analysis to be performed.
- ⟨ Completely fill each sample jar so that no air space (headspace) exists, wipe soil from the jar threads,

and seal the jar using a cap lined with Teflon. The jar should be labeled and placed on ice in a covered, insulated cooler and chilled to 40°F (4°C).

GROUNDWATER SAMPLE COLLECTION

How are groundwater samples collected?

- ⟨ Groundwater samples should be collected from properly designed, constructed, and developed monitor wells.
- ⟨ Groundwater samples are generally collected from monitor wells with decontaminated bailers or disposable bailers.
- ⟨ Prior to the actual collection of the sample, the depth to groundwater should be measured as well as the thickness of any present phase-separated product layer. If no product layer is present, the well should be properly purged in order to draw fresh water into the well prior to collection of the sample.
- ⟨ Monitor wells should be sampled in order from least contaminated to most contaminated when possible.

Is it necessary that monitor wells be used to collect groundwater for laboratory analysis?

- ⟨ The TNRCC only considers groundwater samples collected from properly designed, constructed, and developed monitor wells to be acceptable. Groundwater samples collected from borings are not acceptable to the TNRCC. Groundwater samples collected from open excavations such as tank pits may be accepted as initial indicators of groundwater contamination provided:
 - (1) the tank pit intersects the water-bearing zone, and
 - (2) the samples are collected in an appropriate manner.

Generally, groundwater samples collected from open excavations will need to be verified with groundwater samples collected from monitor wells.

- < For general information concerning the installation of monitor wells, please refer to the TNRCC pamphlet entitled *Soil Boring and Monitor Well Installation (RG-19)*.
- < For information regarding required groundwater sampling frequency, please refer to the TNRCC pamphlet entitled *Groundwater Monitoring and Reporting (RG-43)*.

Is it necessary to submit a groundwater sample to a laboratory for analysis if the sample was collected from a well which contains a phase-separated product layer?

- < Generally, groundwater samples should only be collected for laboratory analysis from monitor wells which do not contain a phase-separated product layer on the groundwater. If there is a particular need to analyze the groundwater in these wells, please contact the TNRCC case coordinator prior to submitting the samples for analysis.
- < It may be necessary to collect a sample from the phase-separated product layer for analysis if the product type is unknown.

How should groundwater samples be handled?

- < Each groundwater sample should be collected using clean, disposable gloves and other clean sampling equipment. The specific container type and size required is dependent upon the type of analysis to be performed.
- < Collected samples should be immediately placed in sterilized sample jars and vials supplied by the laboratory.
- < Sample jars and volatile organic analysis (VOA) vials should be filled to the top so that no air space (headspace) is present. The samples should be sealed with Teflon lined caps with septum, labeled, and subsequently placed on ice in a covered, insulated cooler and chilled to 40°F (4°C).
- < Samples should be kept chilled to 40°F (4°C) until analyzed by the laboratory.

SOIL & GROUNDWATER SAMPLE ANALYSIS

What should the samples be analyzed for?

The constituents to be analyzed for are dependent on the type of product that has been released and the nature of the sample (water or soil). When previous analytical results determine that specific constituents are not present, they can be eliminated from any future analyses; however, concurrence from the assigned PST coordinator must be obtained prior to eliminating any prescribed analyses. If the release source is undetermined, samples should be analyzed for all products contained in storage tanks at the site.

< ***GASOLINE***

Soil: BTEX and TPH.

Water: BTEX, TPH, and methyl tertiary butyl ether (MTBE)

< ***DIESEL, JET FUELS, NOS. 1, 2, AND 4 FUEL OILS***

Soil & Water: BTEX, TPH, and polycyclic aromatic hydrocarbons (PAH)

< ***LUBRICATING OILS, HYDRAULIC FLUID, AND NO. 6 FUEL OIL***

Soil & Water: TPH and PAH

< ***UNKNOWN PETROLEUM AND WASTE OIL***

Soil: BTEX, TPH, PAH, volatile organic compounds (VOC) and total metals

Water: BTEX, TPH, PAH, and VOC

< ***HAZARDOUS SUBSTANCES***

Soil & Water: Constituents of substance(s) released

- < Sampling for PAH is only required during site assessments unless otherwise directed by the TNRCC. Polycyclic aromatic hydrocarbons analysis may not be required as part of a storage tank removal from service.

- < Analysis for VOCs should be performed during waste oil and unknown petroleum storage tank removal from service activities. During a limited site assessment, only samples collected from the boring/well closest to the source should be analyzed for VOCs.
- < The analysis for MTBE is only necessary initially following the installation of a monitor well and subsequently, only in monitor wells located down gradient and outside the periphery of a gasoline contaminant plume boundary.
- < On all sites, regardless of the contaminant, a water sample collected from the least contaminated well should be analyzed for total dissolved solids (TDS) to determine groundwater quality.
- < Additional analyses are required for samples collected during the Limited Site Assessment. Please refer to the pamphlet entitled *Limited Site Assessment Guidance Document* for more information.

What analytical methods does the TNRCC prefer be used?

- < TPH analyses for both soil and water should be quantified using EPA Method 418.1 (IR). Soil samples should be prepared using either EPA Method 3540 (Soxhlet extraction) or EPA Method 3550 (sonication extraction) with fluorocarbon 113 as the extraction solvent.
- < BTEX and MTBE should be quantified using EPA Method 8020 (GC/PID) with EPA Method 5030 (Purge and Trap).
- < PAH should be quantified using EPA Methods 8100, 8270, or 8310 as described in SW-846. At minimum, the concentrations of the following compounds should be reported:
 - Acenaphthene, Anthracene,
 - Benzo(a)anthracene, Benzo(b)fluoranthene,
 - Benzo(k)fluoranthene, Benzo(a)pyrene,
 - Benzo(g,h,i)perylene, Chrysene,
 - Dibenz(a,h)anthracene, Fluoranthene,
 - Fluorene, Indeno(1,2,3-cd)pyrene,
 - Naphthalene, Phenanthrene, and Pyrene.
- < VOC should be quantified using EPA Method 8240 (GC/MS). Analyze for the constituents listed

in Table 2 of SW-846 for the description for Method 8240.

- < Total metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) should be quantified using the appropriate EPA Methods as outlined in EPA Manual SW-846.
- < TDS should be quantified using EPA Method 160.1.
- < Soil and water samples collected following the release of a hazardous substance should be analyzed for specific chemical constituents in accordance with the appropriate EPA Method prescribed in EPA Manual SW-846.
- < The TNRCC may request that other specific EPA methods be used if particular contaminants are suspected.

How quickly must the samples be analyzed?

- < BTEX and PAH samples must be analyzed within 14 days of sample collection.
- < TPH samples must be analyzed within 28 days of sample collection.
- < Chemicals should be analyzed within the holding times specified in EPA Manual SW-846.
- < Only samples which have been properly preserved will be accepted by the TNRCC regardless of the time period held prior to sample analysis.

What is chain-of-custody documentation?

The chain-of-custody is a form which documents the history of the sample from the time the sample is collected to the time that the sample is analyzed in the laboratory. This information is needed to prove that the samples are handled and transported in a manner which preserves the integrity of the sample. The chain-of-custody should indicate:

- < who collected the samples (The sample collector must sign the chain-of-custody form.);
- < when the samples were collected (date and time);
- < where the samples were collected;
- < sample identification numbers and codes;

- < sample collection locations and depths;
- < how the samples are preserved; and
- < what the samples are to be analyzed for and often the specific analytical methods that are to be used.

At the laboratory, the technician should sign the chain-of-custody and note the date and time the samples were received and the condition of the samples at the time of arrival. Samples not collected under proper chain-of-custody documentation will not be acceptable to the TNRCC.

Should copies of the actual laboratory reports be provided?

The laboratory reports are the data sheets which contain the analytical results from the laboratory. These reports should contain the following information:

- < the date of collection, the date of extraction, the date of analysis, and the report date;
- < the extraction and analytical methods utilized with descriptions of any modifications of standard procedures;
- < method detection limits;
- < the concentration of the constituent analyzed;
- < the standards utilized in the analysis;
- < the sample identification number, sample type (soil, water, etc.) and sample depths;
- < copies of the chromatograms for GC analyses; and
- < blanks, surrogates, and spike recoveries.

The laboratory reports and chain-of-custody (COC) documentation should be submitted with the appropriate reporting form or report format. Each reporting form or report format specifies the documentation that should be submitted.

Following is a brief guideline on the submittal of laboratory reports:

Laboratory reports and COC documentation should be included with the *Release Investigation Report* (Form No. TNRCC-0016), in the required tank system permanent removal from service documentation, in the Limited Site Assessment (LSA) Report, in the Comprehensive Site Assessment Report, and with the Annual Monitoring Report. Laboratory reports and COC documentation should not be included with the *Monitoring Event Summary and Status Report* forms.

For detailed information regarding the submittal of reporting forms and report formats, please refer to the *Reporting Guidelines for LPST Cleanups in Texas* (Publication No. PST 93-01).

Does the TNRCC regional office need to be notified before samples are collected?

Yes, the appropriate TNRCC regional office should be notified at least 24 to 48 hours prior to conducting sampling activities. If the TNRCC regional inspector requests sample splits or that samples be collected from specific locations, those directives should be followed.

For more information, please contact the Responsible Party Remediation Section of the Petroleum Storage Tank Division at 512/239-2200.



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